

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION**

Board of Regents, The University of Texas
System, and 3D Systems, Inc.,

Plaintiffs,

V.

EOS GmbH Electro Optical Systems,

Defendant.

§ § § § § § § § § §

Civil Action No. A03 CA 113 SS

**EOS'S OBJECTIONS TO THIS COURT'S DECEMBER 3, 2003 OPINION
AND ORDER ON CLAIM CONSTRUCTION**

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I. INTRODUCTION

In reaching its conclusion that the independent claims in suit do not require the removal of bulk heat, this Court relied heavily on the absence of any claim language referring to the removal of bulk heat. What this Court apparently failed to appreciate is that during the prosecution of the patents-in-suit, the Applicant specifically tied *the actual claim language used in the claims* to the removal of bulk heat. For example, during the prosecution of the '589 Patent, the Applicant made the express representation in an Amendment that “moderating the temperature difference” in Claim 1 provides the “important advantages” of reducing shrinkage *and* removing bulk heat to reduce unwanted growth. Later in that same Amendment, the Applicant once again expressly stated that “moderating the temperature difference” reduces shrinkage in the article being produced *and* reduces unwanted growth (by the removal of bulk heat). Thus, the Applicant limited the phrase “moderating the temperature difference . . .” beyond its plain meaning to include the removal of bulk heat. By telling the Patent Office that “moderating the temperature difference” requires the removal of bulk heat to prevent growth, the *removal of bulk heat (to reduce growth) becomes a limitation of the claims even though that phrase does not explicitly appear in the claims as issued.*

In short, the fact that the claims do not literally recite the removal of bulk heat is irrelevant. What is relevant is that the file history statements limit the claim language beyond its ordinary meaning to include the removal of bulk heat. This is simply not a case where the claim requires “element A,” and there is no statement in the file history limiting “element A” beyond its ordinary meaning. Rather, this is a case where the Applicant claimed “element A” (i.e., “moderating the temperature difference . . .”), and then told the Patent Office that “element A”

includes the removal of bulk heat. Thus, the removal of bulk heat becomes a limitation of the claims *even though it does not appear explicitly in the claims*.

II. CLAIM 1 OF THE '589 PATENT--"TEMPERATURE CONTROL MEANS FOR MODERATING THE TEMPERATURE DIFFERENCE . . ."

A. The Prosecution History Compels A Claim Construction That Includes The Removal Of Bulk Heat

The Court's Order only cites to *one* Amendment from the '589 Patent file history--the May 28, 1996, First Submission Under Rule 129. It appears that this Court did not consider or fully appreciate all of the other Amendments, which are binding on the construction of the "temperature control means for moderating a temperature difference . . ." claim limitation found in claim 1 of the '589 Patent. EOS sets forth below each of the relevant amendments in chronological order.

1. The June 23, 1995, Amendment ("the First Amendment")

In the First Amendment, which this Court makes no reference to in its Order, the Applicant explained that:

moderating the temperature difference between the top layer of powder not yet scanned by the directed energy beam and the previously scanned layer provides the important advantages of reducing differential shrinkage of the article being produced (which results from thermal gradients between fused and unfused powder) and in reducing growth of the article into unfused powder (which results from excess bulk heat in the article).

(Exh. B,¹ at p. 563, emphasis added). There are two important things to consider in this passage. First, the Applicant argued to the Patent Office that "moderating the temperature difference," *the same language found in claim 1*, provides the "important advantages" of reducing shrinkage *and growth*. Growth, of course, can only be effected by the removal of bulk heat, as the Amendment

¹ Exhibits B and D attached hereto contain selected pages from Exhibits B and D to EOS's opening *Markman* brief. These pages are being resubmitted for the Court's convenience.

indicates. Thus, the Applicant clearly and unmistakably limited the claim by arguing that “moderating the temperature difference” requires the removal of bulk heat to prevent growth.

According to the Applicant, “moderating the temperature difference” is carried out by heating the top layer to reduce shrinkage *and* by removing bulk heat from the layer immediate beneath the top layer to reduce growth. For example, heating the top layer (to prevent shrinkage) drives the temperature of the top layer toward the temperature of the bottom layer, which moderates (or lessens) the temperature difference between the two layers. Similarly, removing bulk heat from the layer immediately beneath the top layer (to reduce growth) drives the temperature of the bottom layer toward the temperature of the top layer, which also moderates (or lessens) the temperature difference between the two layers.

Second, it is important to note that the Applicant refers to “moderating” to reduce both shrinkage *and* growth in the context of just *two layers*--the top layer and the layer immediately beneath. Indeed, the claim only refers to two layers. This is significant because it proves that “moderating” (or lessening) the temperature difference to prevent shrinkage and growth can both be carried out between the top layer and the layer immediately beneath the top layer, according to the Applicant. Again, removing bulk heat from the bottom layer will moderate the temperature difference between the two layers. This totally undercuts Plaintiffs’ claims that shrinkage is a phenomenon that happens at the “Curl Interface,” while the problem of growth is a phenomenon that happens only deep down in the part at the “Growth Interface.” Of course, there is no such thing as “Curl Interface,” or “Growth Interface” in connection with the patents-in-suit.

Also contained in the very same Amendment is the following passage:

[i]n addition, given the lack of disclosure in Arcella regarding the required *temperature control means*, as discussed above, Arcella does not provide the requisite suggestion. *The lack of suggestion in Housholder and Arcella is especially apparent when one considers the importance of such temperature control in reducing differential shrinkage in the article being produced and in reducing unwanted growth of the article into unfused powder.*

(Exh. B, at p. 564, emphasis added). Here again, the Applicant clearly links the literal claim language to the function of removing bulk heat to prevent growth by stating that the “temperature control means” reduces differential shrinkage and reduces unwanted growth. This limiting statement was made for the express purpose of distinguishing both the Arcella and Housholder references, which, according to the Applicant, lack this type of “temperature control means.” Thus, the “temperature control means for moderating the temperature difference” limitation must be limited to include the removal of bulk heat to prevent growth.

2. The December 22, 1995 Request For Reconsideration (“the Second Amendment”)

In the Second Amendment, which again this Court does not mention in its Opinion, the Applicant stated:

[f]or the above reasons, and further considering the important advantages provided by the invention of claim 17 [which issued as claim 1] in reducing differential shrinkage of the article being produced and in reducing growth of the article into unfused powder, as noted in the specification of the above-referenced application and in the Amendment of June 26, Applicant respectfully submits that claim 17 and its dependent claims are patentably distinct over the prior art applied thereagainst.

(Exh. B, at p. 590, emphasis added). Just like the two passages set forth above in the First Amendment, the Applicant once again focuses on the two aspects of reducing shrinkage and growth in order to distinguish the “invention of claim 17” (issued as claim 1) from the prior art. It is readily apparent in reading the file history that the requirements of reducing shrinkage and

growth relate solely to the “temperature control means” limitation, because that is the only limitation in the claim that is even capable of addressing shrinkage and growth. Thus, the Applicant’s statement that the “invention of claim 17” reduces shrinkage and growth is just a shorthand way of saying that the “temperature control means for moderating the temperature difference . . .” reduces shrinkage and growth, which is perfectly consistent with the two passages from the June 23, 1995, Amendment quoted above.

3. The May 28, 1996 Submission (“the Third Amendment”)

Now we come to the Third Amendment, the only part of the ‘589 Patent file history discussed in this Court’s Order, which states:

Claim 17 is amended to hereinabove to overcome the Section 103 rejection to it and its dependent claims . . . *The claimed invention (i.e., claim 17) provides the important feature of reducing distortion due to a temperature gradient between unfused powder and the previously scanned layer, such distortion being made manifest as shrinkage and growth in the part being produced in layerwise fashion.*

(Exh. B, at p. 605, emphasis added). Yet again, the Applicant focuses on the aspects of reducing shrinkage and growth in describing the “claimed invention.” The claimed invention is, of course, claim 17, which issued as claim 1. Again, the fact that the Applicant did not link specific claim language to the aspects of shrinkage and growth is irrelevant. Those reading the file history would know that reducing shrinkage and growth is carried out by the “temperature control means for moderating the temperature difference” claim element.

B. The Applicant’s Repeated Statements That “Moderating The Temperature Difference” Requires The Removal Of Bulk Heat To Prevent Growth Were Not “Inaccurate”

This Court erroneously concluded that the statement contained in the Third Amendment--that the “claimed invention” reduces growth by removing bulk heat--was an “inaccurate

statement” that “cannot override the claim language itself, which controls the bounds of the claim.” (Order, p. 11). In fact, this statement *was not* inaccurate. As demonstrated above, it is perfectly consistent with the previous repeated assertions made by the Applicant that the “claimed invention,” and in particular, the “temperature control means for moderating the temperature difference . . . ,” requires the removal of bulk heat to prevent growth.

The “inaccurate statement” cases cited by this Court, *Rambus Inc. v. Infineon Techs. Ag*, 318 F.3d 1081 (Fed. Cir. 2003) and *Intervet Am., Inc. v. Kee-Vet Labs., Inc.*, 887 F.2d 1050 (Fed. Cir. 1989), simply have no bearing on this case whatsoever. In *Rambus*, the applicant submitted an amendment with four independent claims, three of the claims having three features, the fourth claim having only one of the three features. In the accompanying remarks, the applicant made a general introductory remark that the “newly submitted claims” are directed to the three features. Even though the fourth claim only contained one feature, the district court construed it as having all three features based on this statement. In concluding that the district court erred by placing too much weight “on a single introductory comment in the prosecution history,” the Federal Circuit reasoned that:

[t]he prosecution history statement introduces in general terms the new claims. In this sense, the statement properly introduces three features that appear in some of the claims. This general introductory statement, however, is not correct in suggesting that these features appear in each of the new claims. This incorrect statement in the prosecution history does not govern the meaning of the claims.

Rambus, 318 F.3d at 1089-90. Thus, the *Rambus* court held that “[t]he claim language itself controls the bound of the claim, not a facially inaccurate remark during prosecution.” *Id.*

In this case, on the other hand, the Applicant repeatedly stated *four times in three different Amendments spanning over almost a year* that “moderating the temperature difference” requires the removal of bulk heat. These were not facially inaccurate remarks. They were intentionally made for the express purpose of distinguishing the claims from the prior art. This case is not about a claim having “element A,” and the Applicant mistakenly telling the Patent Office that the claim requires “element A” and “element B.” This is a case where the Applicant told the Patent Office that “element A” *requires* the removal of bulk heat to prevent growth. Thus, the removal of bulk heat to prevent growth becomes part of the claim even if it is not expressly recited in the claim.

Intervet likewise does not apply. In that case, the applicant amended only one claim to require a “single vaccination scheme.” In the remarks section, the applicant mistakenly stated that all of the pending claims were restricted to the “single vaccination scheme.” The Federal Circuit held that the district court improperly limited all the claims to the “single vaccination scheme,” because the applicant’s remark was clearly untrue. *Intervet*, 887 F.2d at 1054. Again, in this case, there was no mistake, as evidenced by the repeated and consistent statements made by the Applicant that “moderating the temperature difference” requires the removal of bulk heat to prevent growth.

In its responsive *Markman* brief, EOS cited to the very recent Federal Circuit case, *Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314 (Fed. Cir. 2003), which is far more instructive. In *Omega*, the Federal Circuit construed the phrase “to visibly outline” to mean:

the causing of at least one laser beam to strike the periphery of the energy zone for visibly outlining the entire energy zone, *without adding appreciable heat to the energy zone as to affect the accuracy of the temperature measurement.*

Id. at 1328 (emphasis added). Thus, despite the fact that there was no language in the claim referring to not adding appreciable heat to the energy zone, the *Omega* court's construction of "to visibly outline" nonetheless included the requirement of not adding appreciable heat to the energy zone. This construction went well beyond the literal terms of the claim because during prosecution, the applicant repeatedly argued that the "advantage" of the claimed invention is that it would have no effect on the temperature measurement to be taken when it outlines the energy zone. *Id.* at 1326.

The exact same situation is present here. The Applicant repeatedly stated that "moderating the temperature difference" includes the removal of bulk heat to prevent growth. By doing so, he limited the phrase "moderating the temperature difference" beyond its plain meaning to include the removal of bulk heat.²

C. The Claim Language "Moderating The Temperature Difference" Encompasses The Meaning The Applicant Ascribed To It During Prosecution

As stated above, this Court, perhaps troubled by the link between "removing bulk heat" and "moderating the temperature difference," has expressed misgivings about requiring the claim to include the removal of bulk heat when that language is not expressly set forth in the claim. However, the language of the claim itself certainly encompasses the meaning Applicant ascribed to it during prosecution.

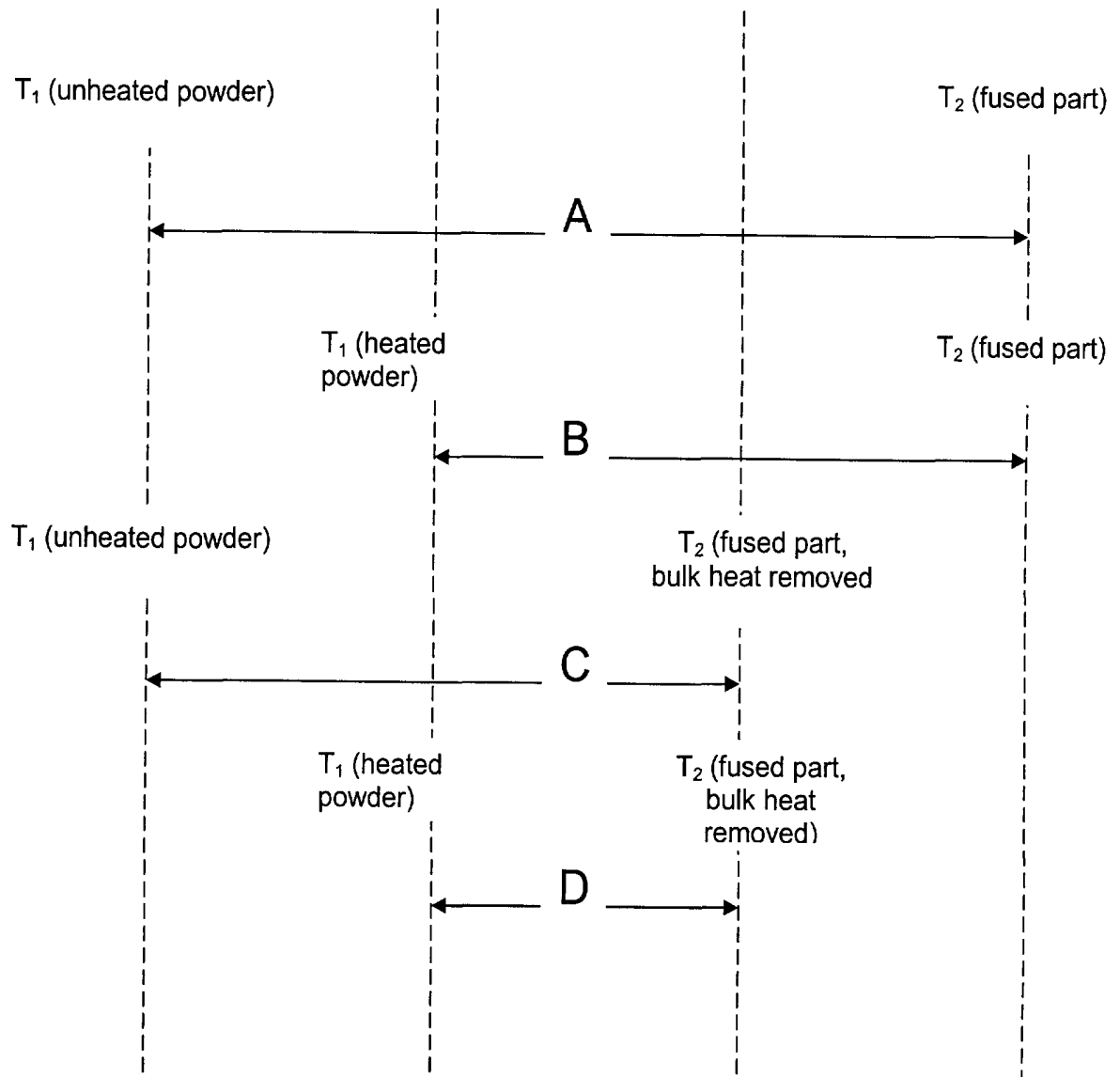
According to this Court, "moderate" means "lessen." The Court then applied this definition to interpret "moderating a temperature difference" between the top layer of unfused powder and the fused part of the bottom layer. Both parties agree that "moderating a

² Because the function of "moderating the temperature difference" must be construed to include the removal of bulk heat, the structure in the '589 Patent specification that corresponds to this function is not just the resistance heater, but rather must also include all of the other aspects of the downdraft system as set forth in EOS's *Markman* briefs.

temperature difference” requires reducing shrinkage, which is accomplished, according to the Applicant, by heating the top layer of unfused powder. The issue presented is whether the claim also requires removal of bulk heat.

As illustrated on the following page, there are three ways to lessen the temperature difference between the unfused powder and the fused part. Line A, at the top, shows the temperature difference between unheated powder T_1 and the fused part T_2 . Line B, immediately below, shows that by just heating the powder, one raises its temperature and thereby lessens the difference in temperature between the powder and the fused part. This is the definition Plaintiffs presented.

Note, however, that Line C also illustrates a way to lessen the temperature difference, by removing bulk heat from the fused part but *not* heating the powder. Neither party has sought this definition, but it is a way to “lessen the temperature difference.” Finally, Line D illustrates “lessening the temperature difference,” this time by heating the powder and simultaneously removing bulk heat from the fused part.



As shown above, “moderating” or “lessening” the temperature difference can be carried out several different ways. During prosecution, however, the Applicant stated that his invention *requires* the type of moderation illustrated in Line D.

III. CLAIM 1 OF THE '070 PATENT--"HEATING . . . TO MODERATE A TEMPERATURE DIFFERENCE"

A. The File History Statements Contained In The '589 Patent Apply With Equal Force To The Related '070 Patent

Having demonstrated that "moderating the temperature difference" in claim 1 of the '589 Patent must be construed to include the removal of bulk heat, the virtually identical phrase "moderating a temperature difference" in claim 1 of the '070 Patent *must* be construed the same way. As this Court is well aware, the '589 Patent and the '070 Patent are closely related in that they each derive from the same initial application,³ and they each have the same specification. It is black letter patent law that the statements made during the prosecution of the '589 patent regarding the claim limitation "moderating the temperature difference" apply with equal force to the '070 Patent, which contains the identical claim limitation (i.e., "moderating a temperature difference"). *Biovail Corp. Int'l v. Andrx Pharm., Inc.*, 239 F.3d 1297, 1301 (Fed. Cir. 2001) ("When multiple patents derive from the same initial application, the prosecution history regarding a claim limitation in any patent that has issued applies with equal force to subsequently issued patents that contain the same claim limitation.")⁴ citing *Elkay Mfg. Co. v. EBCO Mfg. Co.*, 192 F.3d 973, 980 (Fed. Cir. 1999); *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1372 (Fed. Cir. 2003) (Statements in the parent file history limiting a claim term applies to later applications with the same claim term.); *Masco Corp. v. United States*, 303 F.3d 1316, 1324 (Fed. Cir. 2002) ("The prosecution history of a parent application may be considered in construing claim terms."); *Augustine Med., Inc. v. Gaymar Indus., Inc.*, 181 F.3d 1291, 1300

³ See the family tree attached hereto as Exh. H, which EOS submitted to this Court as slide 15 at the *Markman* hearing. As the family tree shows, the '589 Patent is the parent of the '070 Patent. The '070 Patent was a divisional application from the application that ultimately resulted in the '589 Patent.

⁴ This rule also applies to divisional applications. *Desper Prod., Inc. v. Qsound Labs, Inc.*, 157 F.3d 1325, 1339 n.6 (Fed. Cir. 1998).

(Fed. Cir. 1999) (“[T]he prosecution history of a parent application may limit the scope of a later application using the same claim term.”)

As set forth above, the prosecution history of the ‘589 Patent is replete with disclaimers that limit the phrase “moderating the temperature difference” to include the removal of bulk heat to prevent growth. These disclaimers apply with equal force to the ‘070 Patent due to the close relationship between the two patents. Thus, the phrase “moderating a temperature difference” in the ‘070 patent must also be construed to include the removal of bulk heat to prevent growth, consistent with the statements contained in the ‘589 Patent file history.

In its Order, this Court cited to an Amendment in the ‘070 prosecution, but did not interpret that amendment in the context of the related ‘589 Patent file history cited above. That Amendment, dated September 23, 1996, was submitted *after* the ‘589 patent was allowed, and after the three Amendments in the ‘589 file history, which clearly state that the removal of bulk heat is a part of “moderating the temperature difference” between the top layer and the fused portion of the layer immediately beneath the top layer. See Exhibit I, attached hereto, illustrating a timeline of the relevant Amendments for the patents-in-suit.

B. The Statements Contained In The ‘070 Patent File History, Which Are Consistent With The Statements Contained In the ‘589 Patent, Also Dictate That “Moderating A Temperature Difference” Must Be Construed To Include The Removal of Bulk Heat

There is no dispute that during the prosecution of the ‘070 Patent, the Applicant stated that the “method of claim 8 [which issued as claim 1],” and in particular, the step of “heating . . . *to moderate a temperature difference*” has the beneficial effects of both reducing shrinkage in the article and removing bulk heat from the article to prevent growth.

Other beneficial effects are also enabled by the method of claim 8 [which issued as claim 1], including the removal of bulk heat from the article which prevents growth of the article into the surrounding unfused powder.

(Exh. D, at p. 178). This statement is perfectly consistent with everything the Applicant said during the prosecution of the '589 Patent, where the Applicant said *four times on three different occasions* that “moderating the temperature difference” includes the removal of bulk heat. The fact that the “removal of bulk heat” was only mentioned once in this Amendment does not lessen its impact.

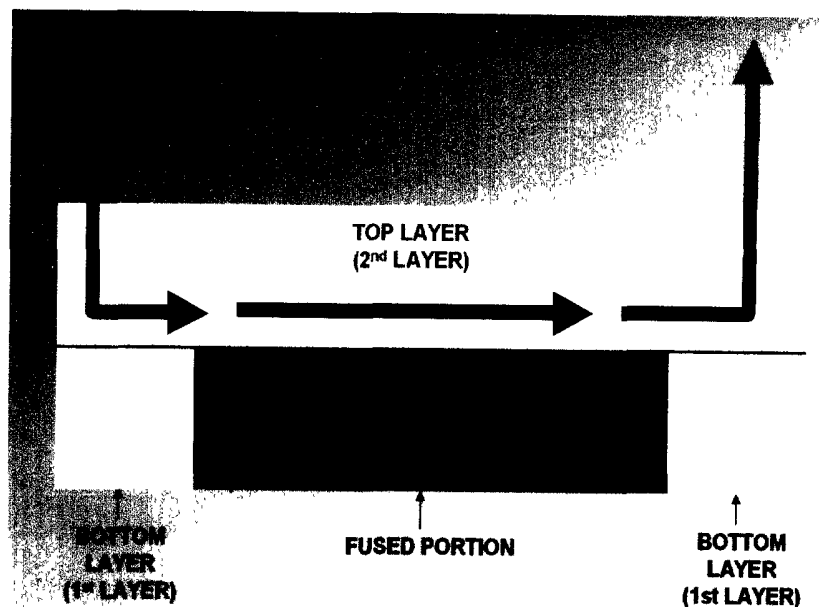
The Court points to a passage immediately before the “other beneficial effects” statement apparently looking for some sort of inconsistency:

As described in the specification . . . the *heating* of the deposited second layer of powder serves to *moderate* the temperature difference between the newly-deposited second layer of powder and the previously-formed article being produced, reducing thermal *shrinkage* in the article.

(Exh. D, at p. 178, emphasis added by the Court). According to this Court, the Applicant “referred only to heating, the Curl Interface, and used ‘moderate’ in the sense of ‘to lessen’ the temperature difference between layers at the Curl Interface.” (Order at p. 5). Thus, the Court apparently believes that because the claim requires heating the second (top) layer, “to moderate a temperature” cannot include the removal of bulk heat from the first (bottom) layer to prevent growth. This simply is not true, as demonstrated below.

Just like claim 1 of the '589 Patent, claim 1 of the '070 Patent only deals with two layers, the bottom layer having fused portions and the top layer of unfused powder that is applied over the bottom layer. As shown in the figure below, the fused portions in the bottom layer, which contain bulk heat as a result of the laser energy being applied thereto, are in direct contact with the top layer of powder. The heat from the fused portions radiates outward in all directions,

including upward into the top layer. What this Court apparently overlooked is that the claim recites not just heating the top layer of powder, but heating of the top layer to a temperature *below the sintering temperature*. Thus, the heat that is applied to the top layer is “warm” relative to the top layer, but is “cool” relative to the fused portions in the bottom layer that are radiating heat into the top layer. The figure below illustrates that convective heated air (at the temperature below the sintering temperature) can pass through the top layer and remove bulk heat from the fused portions of the bottom layer, *even if the convective air does not pass through or into* the bottom layer.



Thus, heating the second layer *to a temperature below the sintering temperature* to moderate a temperature difference can result in reducing *both* shrinkage and growth. Shrinkage is reduced because the incoming heat warms the temperature of the second layer to moderate (or lessen) the temperature difference between the top layer and the bottom layer. Growth of the fused portions (into surrounding powder) is reduced because the incoming heat is at a temperature *below* the temperature of the fused portions.

On page 6 of its Order, this Court refers to two other portions of this Amendment for the proposition that the Applicant “referred only to the Curl Interface, and only to adding heat to lessen the temperature differential between the layers.” (Order, p. 6). Again, as stated above, heating the second layer *to a temperature below the sintering temperature* has the “beneficial effects” of reducing both shrinkage (by heating the top layer) and preventing growth of the fused portions of the bottom layer into surrounding unfused powder (by cooling the fused portions).

Finally, the Court relies on dependent Claim 6 to support its conclusion that Claim 1 cannot be construed to require the removal of bulk heat to prevent growth. However, construing Claim 1 to require the removal of bulk heat to prevent growth does not violate the doctrine of claim differentiation because Claim 6 still has other limitations not found in Claim 1. For example, Claim 6 requires that the exhausting of heated gas be performed *from below* the target surface, whereas Claim 1 does not specify where the exhausting of heat gas is to be performed (i.e., exhausting could place from other locations and still fall within the scope of Claim 1). Thus, Claim 6 does not preclude a construction of Claim 1 that includes the removal of bulk heat to prevent growth.

C. The Court’s Construction Of “To Moderate a Temperature Difference” Renders That Phrase Meaningless, And Is Improper Under the Law

The Court’s construction of the phrase “to moderate a temperature difference” renders that phrase meaningless. Under existing precedent, terms of a claim are presumed to have meaning, and are not to be construed so as to find them redundant or superfluous. *See Lantech, Inc. v. Keip Mach. Co.*, 32 F.3d 542, 546 (Fed. Cir. 1994) (“All limitations in a claim must be considered meaningful.”)

By finding that all that is required of the claim is to heat the second layer of powder to lessen the temperature difference between the second layer of powder and the fused powder below, the Court has assigned no meaning to the phrase, “to moderate a temperature difference.” This can

be seen by comparing the actual claim language (on the left, italicizing the phrase “to moderate a temperature difference”) with the claim language on the right (in which the phrase “to moderate a temperature difference” is not present). Under the Court’s construction, these are the same:

heating the second layer of powder to a temperature below the sintering temperature of the powder, <i>to moderate a temperature difference between the second layer of powder and fused portions of the first layer of powder therebeneath</i>	heating the second layer of powder to a temperature below the sintering temperature of the powder
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Note that, even without the phrase “to moderate a temperature difference,” more than heating is required by this phrase. The claim requires heating the second layer of powder to a temperature below its sintering temperature. Although EOS will prove that the term “sintering temperature” is indefinite, it can be assumed that whatever that temperature is, it is below the temperature of the “fused portions of the first layer of powder therebeneath.” Thus, by raising the temperature of the cooler powder to some temperature “less than” the temperature of the fused portions, one has already “lessened the temperature difference” between the fused portion and the second layer of powder.

This is all the Court has required the claim to mean. Consequently, the claim means the same with or without the phrase “to moderate a temperature difference between the second layer of powder and fused portions of the first layer of powder therebeneath.”⁵

⁵ Note that this very point was made by the Patent Examiner when noting that, if heating is all that is required to moderate a temperature difference, then Arcella discloses moderating a temperature difference. The Applicant responded to the Examiner by explaining that “moderating” provided the additional benefit of removing bulk heat.

But the law instructs that this is incorrect. In *Lantech*, the Federal Circuit reversed a district court's determination of non-infringement based on the district court's erroneous eradication of a claim term from its claims construction. The claim at issue required "at least two conveyor means," yet the district court concluded that "no word or phrase . . . requires the conveyor means . . . to be structurally independent of each other." *Lantech*, 32 F.3d at 546. The Federal Circuit reversed, holding that the "[a]ll limitations in a claim must be considered meaningful" and thus the district court's interpretation would be discarded where it improperly rendered the "at least two" limitation meaningless. *Id.*

Here, as demonstrated above, this Court's construction of heating the second layer "renders meaningless" "to moderate a temperature difference." Under *Lantech*, such a construction is impermissible.

Consequently, for this reason alone, the Court's claim construction is erroneous. In view of the file histories of the '589 and the '070 patent, however, there can be no doubt that the Court reached an incorrect claim construction, and must determine the meaning of the claim term "to moderate a temperature difference."

IV. CONCLUSION

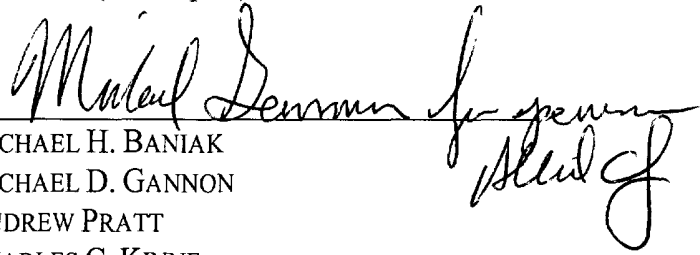
As for the other disputed terms, this Court simply chose not to construe them. Although EOS believes that this Court should have construed these other terms, and will nonetheless have to construe them at some point, EOS will not burden the record at this time by repeating arguments that are already fully set forth in its *Markman* briefs.

Respectfully submitted,

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EXH B

controlled laser and mirrors substantially as claimed, with the exception of a temperature control means. The Examiner asserted that Housholder suggests using a temperature control means at column 8, lines 28-60. The Examiner further asserted that Arcella teaches that it is well known in the powder fusing art to use a separate temperature control means for the purpose of ensuring a more uniform temperature and reducing laser energy usage, citing Arcella reference numeral 39; Figures 1-2; and column 6, lines 50-64. Therefore, the Examiner concluded that it would have been obvious to one of ordinary skill in the art to employ separate temperature control means in the apparatus of Housholder in order to reduce laser energy use and to ensure a more uniform temperature, as taught by Arcella.

Independent claim 17, as well as dependent claims 19 and 20, are amended above in response to this rejection, and Applicant respectfully submits that the amendment to claim 17 overcomes this rejection for the following reasons. First, amended claim 17, and each of its dependent claims 19-26, now require "temperature control means for moderating the temperature difference between unfused powder at the target surface and the cross-section of the part immediately therebeneath". As discussed in the specification at page 14, line 19 to page 15, line 9, moderating the temperature difference between the top layer of powder not yet scanned by the directed energy beam and the previously scanned layer provides the important advantages of reducing differential shrinkage of the article being produced (which results from thermal gradients between fused and unfused powder) and in reducing growth of the article into unfused powder (which results from excess bulk heat in the article). Indeed, for certain materials, it has been observed that the successful production of a part may not be possible without such temperature control.

Applicant respectfully submits that the Arcella reference does not teach a temperature difference between unfused powder at the target surface and the cross-section of the part immediately therebeneath, much less a temperature control means for moderating such a temperature difference. In contrast, Arcella merely discloses an electrical heater 39, or the heating of its fluidizing gas, to heat the powder in its fluidized bed in order to (1) "keep the part at a more uniform temperature and thereby provide heat

treatment and stress relief", (2) "require less laser or electron gun energy to fuse the powder", and (3) "permit the fabrication of structures, such as tungsten, which are brittle and difficult to work with". Arcella reference, column 6, lines 50-64. Significantly, although the Arcella reference discloses the layerwise fabrication of a part 16 from a powder (Arcella reference, column 3 line 51 through column 4, line 9), Arcella contains no disclosure whatsoever that a temperature difference exists between a layer of unfused powder on the top of part 16 and the cross-section of part 16 immediately therebeneath, much less any disclosure that electrical heater 39 or its heated fluidizing gas moderates such a temperature difference. In contrast, Arcella merely discloses that electrical heater 39 or its heated fluidizing gas heats the powder in its fluidizing bed for the above-cited reasons. Finally, as noted by the Examiner, Housholder does not teach a temperature control means. Therefore, Applicant respectfully submits that the combined teachings of the Housholder and Arcella references fall short of amended claim 17, and Applicant respectfully submits that amended claim 17, and each of its dependent claims 19-26, are patentable over these references.

Second, Applicant respectfully submits that there is no suggestion in the prior art to modify the combined teachings of Housholder and Arcella to provide a temperature control means as required by amended claim 17. Contrary to the assertion of the Examiner, the Housholder reference does not suggest such modification. In contrast, column 8, lines 28-60 of Housholder merely disclose using a series of masks and a heat source to fuse an entire layer of particles to form successive layers of a part, and therefore contain no disclosure or suggestion regarding a temperature difference between unfused powder at the target surface and cross-section of the part immediately therebeneath, much less a temperature control means for moderating such a temperature difference. In addition, given the lack of disclosure in Arcella regarding the required temperature control means, as discussed above, Arcella does not provide the requisite suggestion. The lack of suggestion in Housholder and Arcella is especially apparent when one considers the importance of such temperature control in reducing differential shrinkage in the article being produced and in reducing unwanted growth of the article into unfused powder. For these reasons, Applicant

references in such a manner as to reach the requirements of amended claim 17. As asserted in the Amendment of June 26, the Housholder and Arcella et al. references lack suggestion to modify their teachings to provide the claimed temperature control means. In particular, Applicant respectfully submits that there is no such suggestion provided by the Europe 0173654 reference, considering that the problem addressed by the invention of claim 17 and its dependent claims is not present in its disclosed apparatus, much less the solution suggested thereby. Such lack of suggestion by the Europe reference is especially apparent considering the absence of any unfused powder at the workpiece surface. Without unfused powder at the target surface, there can be no temperature difference between such unfused powder and the cross-section of the part immediately therebeneath. It is therefore impossible for the Europe reference to add any suggestion to modify its teachings, and those of the Housholder and Arcella et al. references, to provide the claimed temperature control means.

For the above reasons, and further considering the important advantages provided by the invention of claim 17 in reducing differential shrinkage of the article being produced and in reducing growth of the article into unfused powder, as noted in the specification of the above referenced application and in the Amendment of June 26, Applicant respectfully submits that claim 17 and its dependent claims are patentably distinct over the prior art applied thereagainst.

Based on the above arguments, Applicant respectfully submits that the final rejection of claims 17, 19, and 22 through 26 is in error, and that all of the claims in this case are in condition for allowance.

Please direct all further correspondence in the above-referenced application to the undersigned at the address specified in the Change of Correspondence Address filed herewith.

Claim 17 is amended hereinabove to overcome the Section 103 rejection to it and its dependent claims. Amended claim 17 now requires that the apparatus include means for successively dispensing a plurality of layers of powder at a target surface, in combination with, among other elements, temperature control means for moderating the temperature difference between unfused powder in a topmost layer of powder at the target surface and fused powder in the one of the plurality of layers of powder immediately beneath the topmost layer. Support for this amendment may be found in the specification as filed at page 14, line 19 through page 15, line 9. As described thereat, the claimed invention provides the important feature of reducing distortion due to a temperature gradient between unfused powder and the previously scanned layer, such distortion being made manifest as shrinkage and growth in the part being produced in layerwise fashion.

Applicant respectfully submits that amended claim 17, and all of its dependent claims, are patentably distinct over the references applied thereagainst, on the grounds that the combined teachings of the references fall short of the requirements of the claim.

Applicant agrees with the Examiner that neither of the Housholder and Arcella et al. references disclose the moderation of the temperature difference between unfused powder at the target surface and the cross-section of the part therebeneath (Office Action of September 22, 1995, ¶2). Accordingly, Applicant now respectfully submits that the Housholder and Arcella et al. references, taken in combination, also fail to disclose moderation of the temperature difference between unfused powder in a topmost layer of powder at the target surface and fused powder in the powder layer immediately beneath the topmost layer, as now required by amended claim 17.

Applicant respectfully submits that Europe reference also lacks disclosure regarding this temperature moderation as now claimed in amended claim 17. As is evident from the Europe reference, its teachings are directed to the surface treatment of a metal article using a laser, and with the addition of added material (Abstract). However, nowhere does the reference anywhere disclose the use of successively dispensed layers of powder, as the method disclosed therein clads a metal article with a single layer of added material. Therefore, the Europe

EXH D

Claims 8, 17 through 21, and 24 through 26 remain in this case. Amendment is presented hereinabove to claim 8. Claims 22 and 23 are proposed to be canceled.

Claims 8, 17 through 24, and 26, were finally rejected under Section 102(e) as anticipated by the Arcella et al. reference. The Examiner asserted that the reference teaches all elements of claim 8, including the heating of the powder to a temperature below its sintering temperature.

In addition, claims 8 and 17 through 26 were finally rejected under Section 103 as unpatentable over the Arcella et al. reference in view of the Hydronetics article. The Examiner asserted that the Arcella et al. reference lacks teachings relative to the counter-rotating roller, but that the Hydronetics article teaches the use of a roller. The Examiner admitted that the Hydronetics article lacked teachings relative to counter-rotation of the roller, but the Examiner found such counter-rotation to be well known in the art. The claims were rejected accordingly.

Amendment is presented hereinabove to claim 8 to further clarify its patentability over the prior art applied thereagainst. Proposed amended claim 8 now recites that unfused portions of the first layer of powder remain in place after the first directing step, and that the step of depositing a second layer of powder deposits the powder over both fused and the remaining unfused portions of the first layer of powder after the directing step, so that the second layer of powder is supported by the fused and remaining unfused portions of the first layer of powder. Proposed amended claim 8 also further recites that the step of heating the second layer is performed after the depositing step; claims 22 and 23 are proposed to be canceled accordingly.

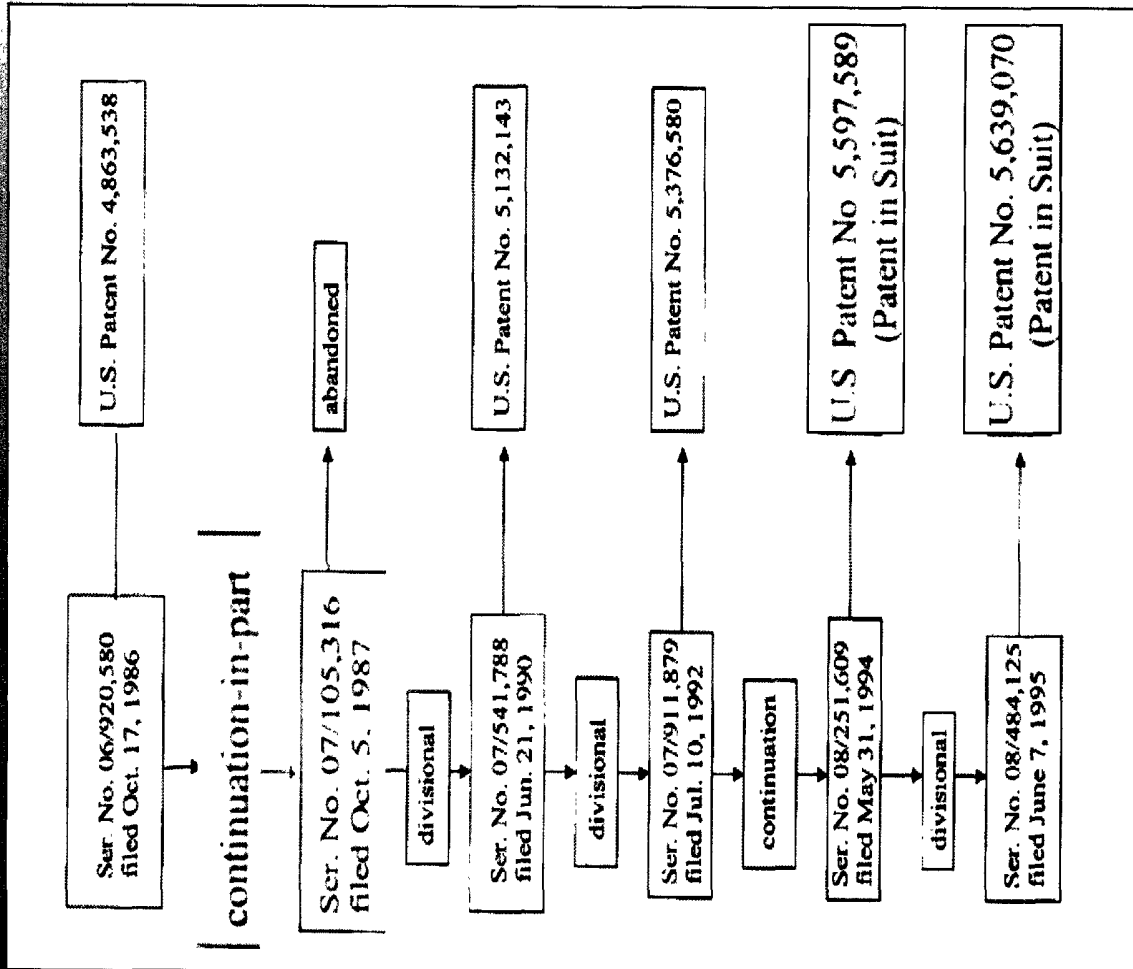
As previously argued and as now further clarified in the claim, the method of proposed amended claim 8 provides important benefits in the fabrication of three-dimensional articles. As described in the specification of the above-referenced application at page 14, line 19, through page 15, line 9, the heating of the deposited second layer of powder serves to moderate the temperature difference between the newly-deposited second layer of powder and the previously-formed article being produced, reducing thermal shrinkage in the article. Other beneficial effects are also enabled by the method of claim 8, including the removal of bulk heat from the article which prevents growth of the article into the surrounding unfused powder.

EXH F

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Patent Nos.

5,639,070



EXH I

TIMELINE FOR THE '589 AND '070 PATENTS-IN-SUIT

